2.0 LPGAC COMPONENT DESCRIPTION

This section provides details on various components of the groundwater treatment systems. In addition to existing and proposed LPGAC components, this section presents information on the extraction system, collection system, existing air strippers, and treatment system bypass configuration.

2.1 EXTRACTION WELLS

Groundwater will be extracted from five new wells located near the groundwater plume front south of Baseline Street. Detailed extraction well location information is presented in Subsection 1.4. Table 2-1 presents information on total depth, screened intervals, diameter, and expected flow rate of the wells. The City expressed preference for submersible well pumps on all new wells. Submersible pumps are usually reliable and require minimal maintenance. There is no need for a special lubrication system consisting of either water or oil lubrication. Submersible pumps are less disruptive in a residential neighborhood because there is no noise generation and no or only a small building required to house the wellhead. The smaller wellhead building reduces problems related to vandalism, such as graffiti. Submersible pumps are available in the required design range. A below-grade or above-grade wellhead completion will depend on several factors such as location and access to the well site. However, the DHS-ODW does not usually allow below-ground completion of production wellheads because of possible contamination by stormwater.

The extracted groundwater is expected to be clear and low in total suspended solids (TSS). However, after installation and development, each well's discharge will be tested for TSS and grain size distribution. Solids present in the water may either settle out in the pipelines or in the LPGAC filters, restricting water flow. If TSS are of concern, a filter or desander will be installed at the wellhead.

2.2 INFLUENT PIPELINE

Newmark Extraction Well No. 3, pumping at a rate of 2,000-gpm, will be connected to the 17th Street Plant by a 16-inch-diameter pipeline. Newmark Extraction Well No. 2, 4, and 5, each pumping at a rate of 1,700-gpm, will be manifolded with 16- to 24-inch-diameter pipelines. From the manifold, a 24-inch-diameter pipeline will convey the extracted groundwater northward on Mountain View Avenue across Route 30 Freeway to the Waterman Plant. The lower portion of this pipeline will be installed in a common trench with the 16-inch-diameter pipeline from the manifold to 17th Street. At 17th Street, a pressure reducing crossover station will allow water to be diverted from the wells dedicated to the Waterman facility to the 17th Street facility. At the Waterman Plant, a cross-over with a normally closed valve will connect the new raw water pipeline with the existing raw water distribution header supplying the air strippers. The raw water distribution piping will be installed below ground. The above ground portion of the individual feed lines to each air stripper is of 16-inch-diameter steel pipe. Piping to and from the new LPGAC plant will tie into the existing plant piping as shown on Sheet C-3 and Sheet C-9 (URSG 1997a). The City will provide tie-ins with existing plant piping, and will provide required transition fittings if different pipe materials are present.

Table 2-1

NEWMARK OU SOUTH PLUME EXTRACTION WELLS

Newmark Extraction Well No.	Total Depth (ft)	Screened Intervals (ft)	Diameter (in)	Flow Rate[1] (gpm)	Pump Type
1	1,200	600-1,180	16	1,700	Submersible
2	1,080	500-1,070	16	1,700	Submersible
3	810	240 - 280 320 - 400 500 - 800	16	2,000	Submersible
4	1,200	490 - 1,180	16	1,700	Submersible
5	1,150	400 - 1,130	16	1,700	Submersible

Notes:

[1] Flow rate from each extraction well is based on the groundwater modeling. The design flow rate through the conveyance pipeline and treatment plant is obtained by adding 10 percent factor of safety to the flow rate shown in the table.

Total depths, screened intervals and diameters of the wells are based on information provided by the City of San Bernardino Water Department.

Newmark Extraction Well No. 3 will be piped directly to the 17th Street Water Treatment Plant facility.

Newmark Extraction Well No. 2, No. 4, No. 5, will be piped to the Waterman Water Treatment Plant.

Newmark Extraction Well No. 1 will be piped to Muscoy OU Water Treatment Plant which is proposed at 9th street and Garner Avenue (on the South-west corner of Encanto Park).

ft Feet
in Inch
gpm Gallons per minute

The City requested a means of treating the LPGAC effluent through the existing air strippers at the Waterman Plant in case a change in MCLs will require removal of Freon® in the future. Stub-outs will be provided on the air stripper inlet manifold and the LPGAC discharge line. The piping connection between the two lines and the associated valves will be added in the future if Freon® treatment is required.

2.3 LPGAC ADSORPTION SYSTEM

The proposed LPGAC adsorption system will employ multiple pairs of adsorption vessels containing granular activated carbon (GAC) that will be regenerated off-site through emptying spent carbon from the vessels and transporting the material to an approved carbon regeneration facility. This technology is widely accepted and used in the drinking water industry. The vessels will be refilled with virgin or regenerated GAC. Until recently, municipal drinking water plants were required to use virgin GAC only. However, attempts by several municipalities (with the City in a lead position) to relieve this rule, resulted in an alteration of the requirements. The DHS is now allowing the use of regenerated carbon if, among other requirements, the carbon is treated in special plants designated for drinking water applications only, and if the carbon is tracked through the entire process to ensure that the material is not mixed with carbon from other locations. This change in requirements will result in lower operation costs.

The raw water will be delivered to the sites by new raw water pipelines. The raw water will be treated by the LPGAC filters and then discharged into the reservoirs. The water level in the LPGAC filters will be above the water level in the reservoir. To maintain LPGAC vessels full of water at all times, the discharge piping will be equipped with pipe loops extending above the top of the filters. The design basis for the proposed treatment systems is presented in Tables 2-2 through 2-4. Site layout for the Waterman Plant is presented on Sheet C-4 (URSG 1997a). The concentration data presented in Table 2-3 is based on analytical results from recent groundwater monitoring events at Newmark OU, and on actual influent data at four existing groundwater treatment plants in the Newmark OU area. The contaminant concentrations presented in Table 2-3 are conservative estimates for the South Plant. For comparison, Appendix B summarizes groundwater analytical results.

The LPGAC systems will be designed to treat groundwater to meet drinking water standards for both PCE and TCE at 5 parts per billion (ppb). However, the LPGAC system will be operated in a serial (double-pass) configuration. Breakthrough of contaminants will be monitored between the two LPGAC filters, and no detectable residual carcinogens will remain in the treated water stream. The legend sheet and typical process flow diagram (PFD) of the proposed systems, along with the required connections to existing piping, are presented on Sheets G-4 and P-7 (URSG 1997a), respectively.

The LPGAC systems are connected to off-site extraction wells and will treat the water prior to discharge to on-site storage reservoirs. The existing 17th Street Plant will be modified to allow double-pass treatment of groundwater through the existing six vessels, which will reduce the design flow of the 17th Street Plant to approximately 2,200-gpm. The remaining raw water will be pumped to the Waterman Plant where a new 5,600-gpm LPGAC system will be installed adjacent to the existing air stripping facility. The entire Waterman Plant LPGAC system, which includes eight pairs of LPGAC vessels with the required piping manifolds and valves, will be provided by one vendor. Other components that may be provided by different vendors are: concrete foundation, pipe headers, yard piping, valves, backwash sumps, chlorination system, and electrical controls with line pressure sensors, rupture disk sensors, and flow meters.

Table 2-2

DESIGN BASIS FOR LPGAC SYSTEMS WATERMAN PLANT:

Influent Pipe Yard Piping	
Material (all new plant piping)	Steel Schedule 40 standard weight
Diameter	24 in
Carbon System	
Carbon Unit Type	Calgon Model 10, Westates HP-20-11-700, Northwestern Carbon LF-810, or approved equal
Number of Carbon Units	8 serial pairs in parallel
Total Design Flow Rate	5,610-gpm
Design Flow Rate per Pair	700-gpm
Weight of Carbon per Unit	20,000 lb
Weight of Carbon per Pair	40,000 lb
Carbon Usage Rate (estimated)	445 lb/day
Estimated Carbon Life	360 days
Diameter per Vessel	10 ft.
Carbon Unit Height	≈ 20 ft. overall
Carbon Unit Shipping Weight (per pair)	48,000 lb
Carbon Unit Weight (operating, per pair)	253,000 lb
Carbon Volume per Unit	714 ft^3
Flange Connection	8" pipe
Carbon Unit Pressure Rating	75 psi
Unit Material	Mild Steel
External Coating	Prime and Paint
Internal Coating	Vinyl Ester
Piping Material	Steel Schedule 40
Backwash Type	Manual Valve

Table 2-2 (Cont'd.)

DESIGN BASIS FOR LPGAC SYSTEM

Carbon	
Type of Carbon	Virgin or Reactivated Filtrasorb 300, or approved equivalent
Apparent Density	28-32 lb/ft^3
Pore Volume	0.85 cm^3/g
U.S. Standard Sieve Size	8 x 30
Larger than No. 8, max.	15%
Smaller than No. 30, max.	5%
Effective Particle Size	0.8 - 1.0 mm
Moisture, max.	2%
Iodine Number (AWWA)	900 min.
Abrasion Number, min.	75
Uniformity Coefficient, max.	2.1
Backwash	
Flow	1,500 gpm, maximum
Time	15 minutes
Volume	3,000 ft^3
Electrical (Controls)	
Requirements	120 Volt single phase
Location	Existing Transformer/Control Room
Emergency Power	None
Process Controls	TBD
Reservoir Hydraulic Grade Line	1,249 feet

Table 2-2 (Cont'd.)

DESIGN BASIS FOR LPGAC SYSTEM

17TH STREET PLANT:

Influent Pipe Yard Piping	
Material (all new plant piping)	Steel Schedule 40 standard weight
Diameter	16 in.
Carbon System	
Carbon Unit Type	Existing
Number of Carbon Units	6 vessels in parallel, to be modified for serial operation
Total Design Flow Rate	2,200-gpm
Design Flow Rate per Pair	733-gpm
Weight of Carbon per Unit	20,000 lb
Carbon Usage Rate (estimated)	174 lb/day
Estimated Carbon Life	344 days
Diameter per Vessel	≈ 11 ft.
Carbon Unit Height	≈ 20 ft. overall
Carbon Volume per Unit	714 ft^3
Carbon Unit Pressure Rating	75 psi
Unit Material	Mild Steel
External Coating	Prime and Paint
Internal Coating	Vinyl Ester
Piping Material	Steel Schedule 40
Backwash Type	Manual Valve
Carbon	
Type of Carbon	Virgin or Reactivated Filtrasorb 300, or approved equivalent
Apparent Density	28-32 lb/ft^3
Pore Volume	0.85 cm^3/g
U.S. Standard Sieve Size	8 x 30

Table 2-2 (Cont'd.)

DESIGN BASIS FOR LPGAC SYSTEM

Larger than No. 8, max.	15%
Smaller than No. 30, max.	5%
Effective Particle Size	0.8 - 1.0 mm
Moisture, max.	2%
Iodine Number (AWWA)	900 min.
Abrasion Number, min.	75
Uniformity Coefficient, max.	2.1
Backwash	Existing
Electrical	Existing
Process Controls	TBD
Reservoir Hydraulic Grade Line	1,151 feet

Note:

TBD	To be determined.		
psi	Pounds per square inch		
in	Inches	gpm	Gallons per minute
lb	Pound	cm^3/g	Cubic centimeters per gram
ft	Feet	mm	Millimeter
ft^3	Cubic feet	min.	Minimum
AWWA	American Water Works Association	max.	Maximum

Table 2-3

ESTIMATED LOADING RATES TO THE LPGAC SYSTEMS

Constituent in Water	Influent Concentration (ppb)	MCL Fed/CA
Tetrachloroethene	35	5/5
Trichloroethene	7	5/5
cis-1,2-Dichloroethene	3	70/6
Chloroform	0.2	100/100
Chloroethane	0.4	NE/NE
Methylene Chloride	0.2	5/NE
Toluene	2	1,000/NE
Freon® 11	7	NE/150
Freon® 12	51	NE/NE

ppb	Parts per million
MCL	Maximum contaminant level
NE	Not established
Fed/CA	Federal and California

Table 2-4

DESIGN CRITERIA FOR OTHER LPGAC COMPONENTS

WATERMAN PLANT:

Component	Design Criteria	Design Dimension
Backwash Water Supply	System Water	1,500 gpm @ 90 psi
Spent Backwash Collection Sumps	Storage Volume Length, each Width, each Average Depth, each	22,500 gallons 116 feet 5.5 feet 3.6 feet

17TH STREET PLANT:

Component	Design Criteria	Design Dimension
Backwash Water Supply	System Water	Existing

gpm Gallons per minute
psi Pounds per square inch

2.3.1 17th Street Plant

The 17th Street LPGAC system consists of six existing vessels arranged in parallel. As described in Subsection 2.3, the facility is presently piped for parallel (single-pass) configuration only. To allow serial (double-pass) treatment of groundwater, the piping and valving will be modified.

The existing LPGAC system will also be modified to provide for automated safety features. These features will be interlocked with the existing control panel. System instrumentation details are provided in Section 4.0.

2.3.2 Waterman Plant

The Waterman LPGAC system will consist of two independent trains of LPGAC filters, each interconnected with influent/effluent piping manifold. Based on the design basis presented in Tables 2-2 and 2-3, and vendor-provided data, the new adsorption system at the Waterman Plant will consist of eight pairs of adsorption vessels, each containing 20,000 pounds of GAC. Each pair is equipped with manifolds and valves to allow for either serial (double-pass) or parallel (single-pass) flow configuration and backwashing. A hydraulic contact time of fifteen minutes is required to maintain a high degree of reliability in reaching discharge water quality requirements. Flow through each vessel should be maintained below 750 gpm to minimize pressure drop across the vessels and to prevent short-circuiting in the LPGAC bed. This is described in more detail in Section 1.5. The carbon vessels will be rated at 75 pounds per square inch (psi) and the connected piping will be rated at 125 psi. The pressure drop across each unit at 500 gpm is estimated to be 2 psi, or 4.6 feet of water column. A rupture disk assembly will protect each carbon vessel from overpressurization. The carbon vessels will be built of mild steel, externally primed and painted, and internally coated with vinyl ester.

The proposed adsorption system will be equipped with automated safety features and the system operation will be interlocked with the existing control panel. System instrumentation details are provided in Section 4.0. Design criteria for other system components are listed in Table 2-4.

2.4 BACKWASH SYSTEMS

Water extracted from the new wells is expected to be free of silt and other solids. However, the LPGAC adsorption units may experience an increase in pressure drop across the filter media, which indicates clogging by solids deposits. In this situation the vessel will be taken off-line and the flow through the vessel will be reversed. The purpose of reversing the flow is to expand the carbon bed which facilitates the dislocation of accumulated solids. The flowrate will be adjusted to achieve sufficient force to dislocate solids and flush them into the spent backwash sump.

At the Waterman Plant, the backwash water will be supplied from an existing 20-inch-diameter plant water line. The backwash flowrate will be adjusted by a valve in a range of 800 to 1,500 gpm. The spent backwash water generated during a backwash cycle will be collected in two sumps, one along each LPGAC treatment train. The two sumps are connected using a 12-inch-diameter pipeline. The sump system is designed to hold the volume of one vessel's backwash at a flowrate of 1,500 gpm for 15 minutes. The

sumps are covered with steel grating so that the spent backwash water quality can be visually monitored during a backwash cycle. This allows the operator to reduce the backwash flow rate in case of carbon flush-out. Steel grating will be rated for 1-ton forklift loading.

The Waterman Plant spent backwash water, collected in the two sumps, will be pumped and discharged into the sewer system. A 200-gpm sump pump will be used to pump spent backwash water, which will be conveyed by 4-inch diameter pipe to a sewer manhole located on Waterman Avenue. Sump pump, piping valves and manhole tie-in details are shown in sheet C-gand C-15 (URSG 1997).

The 17th Street Plant has an operable backwash system in place. Spent backwash water is pumped from the backwash drain channel into a sump from which the water can be drained by gravity to the sewer system.

2.5 TREATMENT SYSTEM BYPASS

PCE and TCE concentrations in the influent water are expected to remain above MCLs for several years. Eventually, concentrations may fall below the MCLs and treatment may no longer be required. A means of bypassing the LPGAC systems will be provided to allow direct discharge of groundwater into the reservoirs. At the 17th Street Plant, the necessary piping and valving to bypass groundwater from the treatment system is already in place. At the Waterman Plant, the raw water collection manifold will be connected to the new treated water line that is connected to the reservoir. Valves and a normally removed pipe segment will separate the raw water collection manifold from the reservoir inlet. The removable pipe segment will be installed after approval of the DHS-ODW.

2.6 CHLORINATION SYSTEM

The treated water must be disinfected before final discharge to the reservoirs. At the Waterman Plant, the City's existing disinfection system (chlorination) is capable of handling the flow from the LPGAC system, in addition to the air stripping treatment system. However, to allow proper dosage of chlorine, a new chlorination unit will be installed inside the existing control and chlorine building. A new 1-inch-diameter polyvinyl chloride (PVC) line will be installed to inject chlorine solution before the final discharge to the reservoir. The chlorine dosage will be guided by the total flow rate measured by the effluent flow meter (Appendix E).

At the 17th Street Plant, the existing chlorination system is adequate to disinfect the treated water stream before discharge to the reservoir.

3.0 SITE WORK

This section describes the activities required to install the LPGAC adsorption system and related appurtenances at the Waterman Plant, and activities required to accomplish necessary modifications at the 17th Street Plant.

3.1 WATERMAN PLANT

The LPGAC system at the Waterman Plant will be located directly north of the existing air strippers (Sheet C-8, URSG 1997a). Eight pairs of LPGAC vessels, with related piping, valves, and manifolds, will be installed on concrete pads designed to support the cumulative load of the components of the system filled with water, i.e., approximately 253,000 pounds per pair of LPGAC vessels in operating condition. The vessels will be held in place by anchors sized for Seismic Zone 4 forces. Two concrete pads of approximately 1,750 square feet each will be required. Structural details are presented on Sheet S-2 (URSG 1997a). Structural calculations are presented in Appendix C. All concrete will be rated at 3,000 psi. Reinforcement steel will be Grade 60.

The LPGAC system will be installed with the following features:

- Each carbon vessel will be equipped with a differential pressure gauge and transmitter. Pressure differential will be measured between the inlet and the outlet pipe of each vessel. An increase in pressure differential indicates a blockage in the carbon filter. The differential pressure gauges will be equipped with electrical contacts that can be manually set. The differential pressure sensors will be tied into the remote monitoring system as described in Section 4.0.

- Each pair of carbon vessels will be equipped with a propeller flow meter in the treated water line between the vessel outlet and the treated water header and a pipe loop with an air/vacuum release valve designed to maintain the LPGAC vessels full with water.

- Each LPGAC vessel will be equipped with a rupture disk to protect the vessel from overpressurization. Each rupture disk will be equipped with a burst sensor that will send a signal to the interface cabinet and Supervisory Control and Data Acquisition System (SCADA) system when a rupture disk fails.

- The treated water header will be equipped with a propeller flow meter that is interlocked with the chlorination system.

Detailed information on all gauges, settings, and valve operation will be provided in the Operation and Maintenance (O&M) Manual in Section 7.0.

The carbon vessels will be equipped with the required valves to allow parallel, serial, reversed serial, and backwash operation modes. The butterfly valves will be adjusted manually. During a backwash cycle, the clogged vessel will be taken off-line by adjusting the valves accordingly. The backwash water will be

supplied from an existing 20-inch-diameter plant water pipe. A backflow preventer and a propeller flow meter will be installed in the backwash water supply line. A maximum flow of 1,500 gpm through a carbon vessel is required. The spent backwash water will be discharged through an 8-inch-diameter pipe into the spent backwash channel. A minimum 1.0 foot air gap is maintained between the backwash pipe and the water surface in the channel.

Adjacent to the pads two concrete channels (5.5-feet wide by 3.6-feet deep) will be constructed. The channels will be covered with grating. The proposed concrete pads and channels will be constructed in a vacant grass area owned by the City and located north of the air stripper units. To avoid relocation of an existing playground, the new LPGAC plant will be constructed in two trains of four pairs of LPGAC vessels, each. One train will parallel the north side and the other train the west side of the property. The new LPGAC plant will be accessed from Waterman Avenue. A new ramp and asphalt driveway will be constructed along the north side of the property. The channels will be connected in series by a 12-inch-diameter pipe. The channel system will be sized to hold the volume of one backwash at 1,500 gpm for a duration of 15 minutes (i.e., approximately 22,500 gallons or 3,000 cubic feet, with a freeboard of more than 6 inches). The bottom of the upstream channel will slope 0.5 percent towards the western end of the channel, where a 12-inch-diameter steel pipe will connect the two channels. The bottom of the downstream channel will slope 0.5 percent towards the north end of the channel, where a sump pump will be placed to pump spent backwash water through a 4-inch-diameter PVC pipe to a sewer system manhole located on Waterman Avenue.

The existing air strippers are supplied by three-phase, 60 Hertz, 460-volt electrical service. Power for the proposed equipment will be supplied from the existing air stripper control panel, as described in Section 4.0.

Piping to convey raw water and treated water to and from the LPGAC adsorption modules will consist of connections to the existing yard piping, valves, and steel piping rated at 125 psi. The aboveground piping will be supported with steel pipe supports where required. Joint restrainers will be provided as necessary. A new chlorination unit will be installed inside the existing control and chlorine building. A new 1-inch-diameter PVC line will be installed to inject chlorine solution before the final discharge to the reservoir. The chlorine dosage will be paced by the total flow rate measured by the effluent flow meter.

The treatment area will be enclosed by a security fence, which will match the type of fence currently installed around the air strippers. Part of the existing fence at the north side will be removed. The fence will be expanded to include the concrete pad with the proposed equipment, and the asphalt truck turning area. The proposed treatment area will be equipped with sufficient lighting for maintenance work during night hours. An existing double-wing gate will be relocated to the east end of the LPGAC treatment system to provide access to the LPGAC vessels. Landscaped areas removed or damaged during construction will be restored to pre-construction conditions. Paint colors will be chosen to match existing equipment color schemes.

Each equipment component will be bolted to the concrete pad in consideration of Seismic Zone 4 forces.

3.2 17TH STREET PLANT

The necessary yard and system piping and valving are already in place to operate the LPGAC system. As described in Subsection 2.3.1, the system will be prepared for series (double-pass) treatment operation. The required piping and valving changes to allow series configuration consist of installing cross-over loops between the inlet and outlet pipes of two adjacent LPGAC vessels. The loops and associated valves will provide for parallel (single-pass), serial (double-pass), and reverse serial configurations. After each carbon changeout, the serial configuration will be reversed so that the partly spent secondary vessel is switched into primary position, and the vessel with the fresh carbon will provide final polishing of the groundwater.

The new 16-inch-diameter ductile iron pipeline from the extraction well will be connected to the existing 14-inch-diameter raw water header at a blind flange located at the north end of the plant. The LPGAC system will be amended with the following features:

- Each carbon vessel will be equipped with a differential pressure gauge and transmitter. Pressure differential will be measured between the inlet and the outlet pipe of each vessel. An increase in pressure differential indicates a blockage in the carbon filter. The differential pressure gauges will be equipped with electrical contacts that can be manually set. The differential pressure sensors will be tied into the remote monitoring system as described in Section 4.0.

- The existing propeller flow meters at each carbon vessel will be equipped with transmitters with output for remote telemetry.

The existing plant is supplied by three-phase, 60 Hertz, 460 volt electrical service. Power to the proposed equipment can be supplied from the existing control panel, as described in Section 4.0.

4.0 ELECTRICAL INSTRUMENTATION AND CONTROLS

This section describes the electrical, instrumentation, and control requirements of the Waterman and the 17th Street plant LPGAC systems. The electrical drawings E-1 through E-7 are presented in the plans and specifications package (URSG 1997a).

Electrical products, materials, and installation practices will be suitable for outdoor installation. Control panels installed outdoors shall be within National Electrical Manufacturers Association (NEMA) 4 enclosures, and other outdoor apparatuses and boxes shall be NEMA 3R. Control panels installed indoors shall be within NEMA 12 enclosures and other indoor apparatuses and boxes shall be NEMA 1.

Surface, embedded, or above grade circuits will be installed in rigid galvanized steel (RGS) conduit and below grade conduits will be Schedule 40 PVC. Transition conduits from below grade to above grade will be PVC-coated RGS. All electrical fittings and bodies will be of cast, weather-proof type unless otherwise noted.

The power requirements of the LPGAC system are minimal, and the electrical demand will be significantly less than the present air stripper system. No additional power capacity will need to be added to the site, and power service requirements will be obtained by modification of existing equipment. Power to submersible well pump stations will be obtained for each site by new services from Southern California Edison Company (SCE) and each site will include electrical service entrance equipment and power distribution and control equipment. Well equipment design will be provided by the City.

The operation and control of the LPGAC filtration units is by manual operation. The filter assemblies will be monitored and alarmed as follows:

- High Differential Pressure Alarm (Waterman and 17th Street Plants). Initiate local and remote warning alarm to indicate that filter maintenance is required.

- High Differential Pressure Critical Alarm (Waterman and 17th Street Plants). Initiate local and remote warning alarm to indicate that filter shutdown and isolation should be performed.

  Note: The differential pressure switches above will be adjustable relays, included within a differential pressure indicator. The indicator will be installed on each filter unit and will provide a visual meter indication of the differential pressure.

- Low Pressure and Flow Shutdown (Waterman and 17th Street Plants). Initiate local and remote alarms.

- Flow Transmitters. Included for each pair of filters (Waterman Plant). Flow meters at each 17th Street filter will also be equipped with transmitters. Transmitters will include instantaneous and totalizing local flow indicators and output for remote telemetry.

- Rupture Disk Burst Sensors (Waterman Plant only). Installed at each filter configured to initiate an alarm in case the rupture disk bursts.

Local alarms will be connected to an annunciator panel located in the existing control building at each plant. Remote alarm processing will be provided by existing City's SCADA. Remote alarms will be dry contacts from retransmit relays within the annunciator panel. The remote alarms will be terminated in an interface cabinet furnished and installed by the Contractor. The City will perform the final interconnection of the alarms, prepare the SCADA software modification/configuration, and test the alarms.

The annunciator panel will include visual and audible indicators and include normal annunciator functions (acknowledge, flash, test, silence, and seal-in options).

Exterior lighting will consist of high pressure sodium area luminaires installed on poles. Each luminaire will include photoelectric control. The lighting fixtures will be similar to existing lighting fixtures. Specific or other task lighting, as needed, will be by portable fixtures provided by maintenance personnel.

Power to the site equipment will include 120 volt instrumentation power (differential pressure indicators, rupture disk sensors [Waterman Plant only], and flow transmitters) and power to duplex receptacles, ground-fault circuit interrupter (GFCI) type, at convenient locations among the LPGAC filtration units.

5.0 TREATMENT SYSTEM SAMPLING STRATEGY

Treatment system sampling at each LPGAC filter pair is necessary to:

- Track effectiveness of the LPGAC system.
- Estimate date for carbon replacement.
- Satisfy DHS-ODW permit requirements (Title 22).
- Monitor hydraulic capture of plume through groundwater level measurement.

The details of the sampling requirements are presented in the Newmark OU Remedial Action, Performance Monitoring Program, Field Sampling Plan (FSP) Addendum to the Source OU LTMP FSP (URSG 1997b). Additional sampling will be required to track the effectiveness of the LPGAC system. Sampling intervals will be shorter during the startup phase. Table 5-1 illustrates the types of analyses and sampling intervals.

Table 5-1

PROPOSED LPGAC TREATMENT SYSTEM SAMPLING PROCEDURES

	Type of Analysis	Sampling Intervals			Groundwater Level[1]
		Inlet Port	Intermediate Port	Effluent Port	
Startup phase 10 days	EPA 524	Daily	None	Daily	Daily
6 months optimization	EPA 524	Weekly	Weekly	Weekly	Weekly
Ongoing Operation	EPA 524	Monthly	Monthly	Monthly	Monthly

(1) Groundwater levels will be continuously collected electronically and downloaded on the schedule presented.

6.0 OPERATION AND MAINTENANCE MANUAL

The O&M manual will provide information on O&M of the LPGAC adsorption modules and connected equipment. The O&M manual will include system description, instructions for different operation modes with valve schedule, maintenance schedules, monitoring requirements, and safety information for both the Waterman and the 17th Street Plants. Because a majority of this information comes from the equipment supplier upon delivery, an O&M manual has not been developed at this time. Following final selection of system components, and prior to installation or system operation, a draft O&M manual will be prepared. The probable outline for this document is presented below.

1.0 Introduction

- 1.1 Project Description
- 1.2 General Process Description - Waterman Plant
- 1.3 General Process Description - 17th Street Plant

2.0 Process Components

- 2.1 Connections and Valves Between Existing Yard Piping and Groundwater Treatment System, and System Bypass - Waterman Plant
- 2.2 Connections and Valves Between Existing Yard Piping and Groundwater Treatment System, and System Bypass - 17th Street Plant
- 2.3 Pre-filtration Units and Bypass
- 2.4 Package LPGAC Adsorption Modules
- 2.5 Pressure Sensors and Controls
- 2.6 Flow Meters
- 2.7 Valves and Valve Schedule for Different Operation Modes
- 2.8 Carbon Vessel Sampling
- 2.9 Inlet and Outlet Sampling
- 2.10 Backwash System
- 2.11 Spent Backwash Storage and Discharge
- 2.12 Spent Carbon Replacement
- 2.13 Instrumentation
- 2.14 Electrical
- 2.15 Remote Alarm Transmission

3.0 Operating Procedures

- 3.1 Initial Startup
- 3.2 Routine Startup
- 3.3 Routine Operations
- 3.4 Routine Shutdown
- 3.5 Routine Maintenance
- 3.6 Process Monitoring
- 3.7 Troubleshooting Guide

4.0 Health and Safety

Appendices:

Equipment Specifications and O&M Manuals
Operating Logs

7.0 CAPITAL AND OPERATION AND MAINTENANCE COST ESTIMATES

The revised cost estimates for capital and O&M costs are summarized below. Detailed cost tables are presented in Table 7-1. The revised costs are based on the original Newmark RI/FS costs (URS 1993), updated to reflect the level of detailed understanding of the project at the current stage of the design process, and discussions between the USEPA Work Assignment Manager, the City, and URSG.

The main changes from the Newmark RI/FS cost estimates are:

- The portion for contingencies was reduced.
- The number of extraction wells including pumps and conveyance piping was adjusted.
- The number of LPGAC units was changed to reflect a double-pass configuration with a total contact time of approximately 15 minutes.
- Some treatment facility components, such as effluent tank, chlorination system, booster pumps, and buildings, were deleted or modified according to the changed location of the treatment system and its integration into existing treatment facilities.
- The electrical power costs were revised to consider actual energy for pumping to the required hydraulic grade elevation.
- The LPGAC costs were revised based on the latest concentration data from monitoring wells and from influent of existing treatment plants.

Table 7-1
WATER TREAMENT COST ESTIMATE
NEWMARK OU SOUTH PLANT
SAN BERNARDINO, CA

Description	Quantity Unit	Unit Cost Material [1]	Labor [2]	Estimated Cost	Subtotal
CAPITAL COST					
GW Extraction					
Well Site Access	5 sites	$54,500		$272,500	
Extraction Wells	5,500 lf	$182	$64	$1,350,000	
Extraction Headworks	5 ea	$68,200	$22,700	$454,500	
Subtotal:					$2,077,000
Contingency:	10%			$207,700	
Total GW Extraction Wells				[3]	**$2,284,700**
Pipeline					
Pipeline (17" - 16")	ls			$330,600	
Pipeline (Waterman - 24")	ls			$1,311,400	
Manifold, Drain	ls			$386,200	
Rt 30 Overcrossing	ls			$210,700	
Subtotal:					$2,238,900
Contingency:				$223,890	
Total Pipeline				[4]	**$2,462,790**
Treatment Facilities					
GAC Units	8 pairs	$190,460	$7,020	$1,579,840	
Chlorination System	1 ls	$7,500	$7,500	$15,000	
Structural	1 ls			$150,000	
Site Work & Yard Piping	1 ls			$509,840	

Table 7-1 (Cont'd.)
WATER TREAMENT COST ESTIMATE
NEWMARK OU SOUTH PLANT
SAN BERNARDINO, CA

Description	Quantity Unit	Unit Cost Material [1]	Labor [2]	Estimated Cost	Subtotal
Site Electrical	1 ls			$112,320	
Subtotal:					$2,367,000
Contingency:	10%			$236,700	
Total Treatment Facilities				[5]	**$2,603,700**
SUBTOTAL CAPITAL COST					**$7,351,190**
Construction Management	6.0%				$441,100
GW Monitoring Wells					
Wells	3,900 lf	$82	$167	$978,900	
Subtotal:					$978,900
Contingency:				$97,890	
Total GW Monitoring Wells				[6]	**$1,076,790**
TOTAL CAPITAL COST					**$8,869,080**
ANNUAL O&M COST					
[7] Carbon Usage	lb GAC	$1.00		$258,000	
[8] Material and Labor			[10]	$129,000	
[9] Power			[10]	$129,000	
Monitoring System				$82,000	
TOTAL ANNUAL O&M COST					**$598,000**
PRESENT WORTH OF ANNUAL O&M COST		(30 yrs.,i=5%)		$9,192,730	
TOTAL PRESENT WORTH					**$18,061,810**

Table 7-1 (Cont'd.)
WATER TREAMENT COST ESTIMATE
NEWMARK OU SOUTH PLANT
SAN BERNARDINO, CA

(1) Materials include a 15% markup.
(2) Labor includes a 15% markup for contractor overhead and profit.
(3) Costs based on Well Extraction Technical Memorandum.
(4) Pipeline length based on modified Newmark RI/FS. Changes are: pipeline to 17th Street Plant added, revised pipelength to Waterman Plant, well waste pipeline added.
(5) Costs based on modified Newmark RI/FS. Changes are: no effluent tank, reduced chlorination cost, and no building.
(6) From Newmark OU RA Work Plan.
(7) New operation costs based on updated concentration data and GAC consumption vendor model results. GAC cost assumed at $1.00 per pound GAC.
(8) Cost for material/labor/extraordinary distribution costs estimated at $10/acre-foot.
(9) Cost for higher power costs (standard versus night-only rates) estimated at $10/acre-foot.
(10) Cost provided by USEPA.

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